Data, Information and Knowledge in Healthcare

Centre for Health Informatics

Prof John Chelsom

Runs: 3 hours
Tutor: Prof John Chelsom
Mode of attendance: Classroom

Learning Objectives

- This session provides an overview of data, information and knowledge in healthcare.
- Specific learning objectives are to:

1. Define data, information and knowledge
2. Understand the basic building blocks of data used in healthcare
3. See how data is used to create patient information in clinical records
4. Describe how information and knowledge can be combined for clinical decision making

Data, Information and Knowledge in Healthcare

- Data, information and knowledge
- Foundations of clinical data
- Patient data and clinical records
- Information and knowledge for clinical decisions
- References and Further Reading

Information Sources

- Sources are listed in the references at the end of these slides

Some definitions have been taken from http:thefreedictionary.com.

Retrieved September 2010.

Where consensus on definitions or descriptions Is required, these have been taken from Wikipedia.

Retrieved September 2010.

Data, information and knowledge

Data, Information and Knowledge

Data are individual measurements, values or terms

Data

220 male
20/01/1957
140/85

Information is a collection of interrelated data with meaningful context

Information

The patient is a male, date of birth 20/01/1957 with blood pressure 140/85 and total cholesterol of 220 mg/dL.

Information with context for applying it in the real world.

Knowledge

The risk of coronary heart disease is raised significantly for patients with high blood pressure (≥ 130/85) and raised cholesterol (≥ 200 mg/dL).

Clinical Data

Data (plural of "datum") are typically the results of measurements and can be the basis of graphs, images, or observations of a set of variables.

Data are often viewed as the lowest level of abstraction from which information and knowledge are derived. Raw data refers to a collection of numbers, characters, images or other outputs from devices that collect information to convert physical quantities into symbols, that are unprocessed.

http://en.wikipedia.org/wiki/Data

Forms of clinical data

- Smells
- Sounds
- Spoken words
- Text (written and electronic)
- Numbers
- Drawing
- Images – static, moving
- 3D solids – palpation

Sources of clinical data

- Patient themselves
- Carer, relative, friend, other informant
- Clinician
- Allied health professionals
- Laboratory
- Radiology dept. (imaging)
- Past records

Clinical Information

- There are various ways, and no simple way, to define the concept of information.

Records are a specialized form of information. Essentially, records are information produced consciously or as by-products of business activities or transactions and retained because of their value.

Primarily their value is as evidence of the activities of the organization but they may also be retained for their informational value.

Sound records management ensures that the integrity of records is preserved for as long as they are required.

http://en.wikipedia.org/wiki/Information

- Using this definition, we could consider *clinical information* to be synonymous with *clinical records*.

Clinical Knowledge

Knowledge is defined by the Oxford English Dictionary as

(i) expertise, and skills acquired by a person through experience or education; the theoretical or practical understanding of a subject;

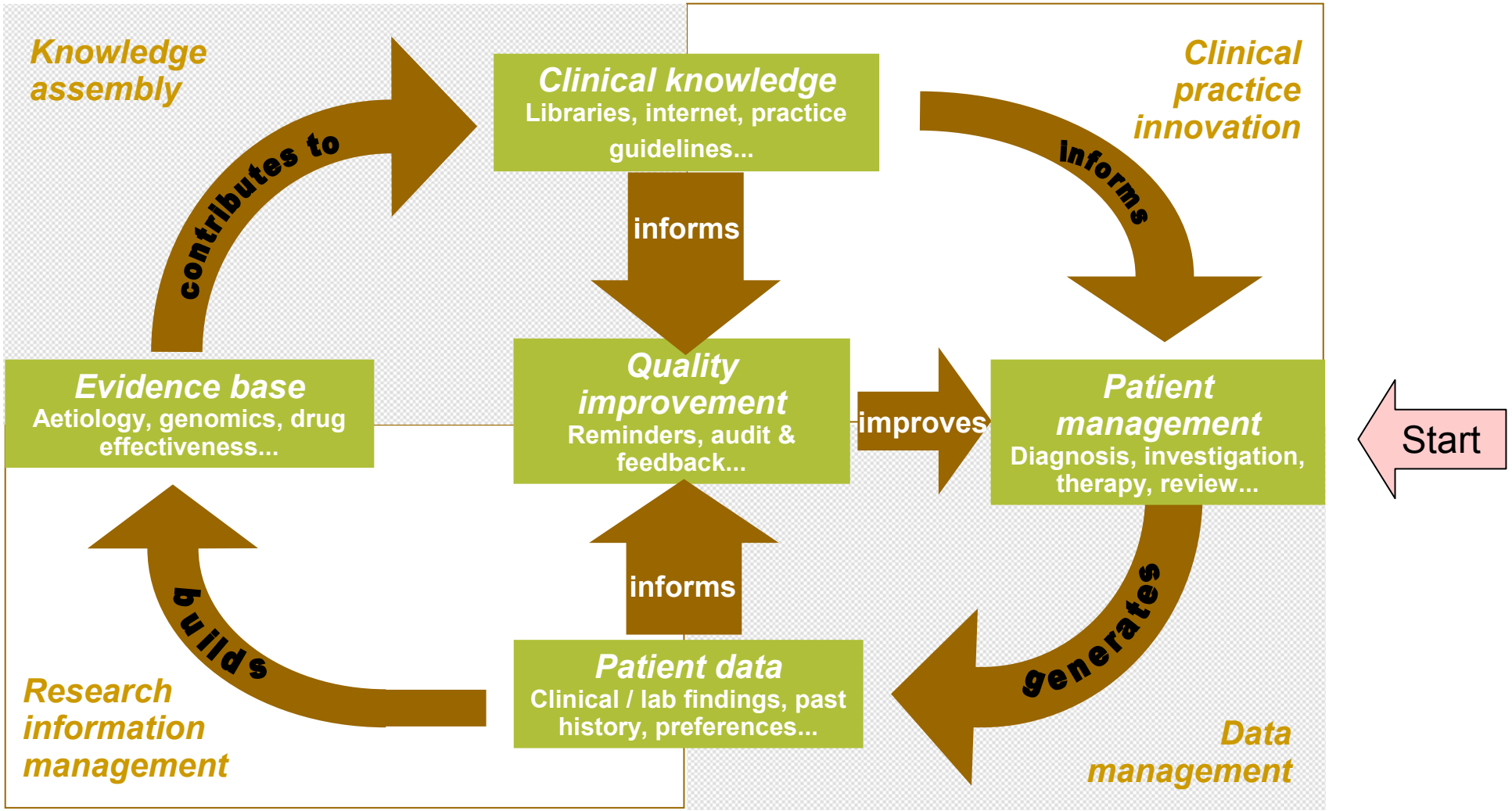
(ii) what is known in a particular field or in total; facts and information;

or (iii) awareness or familiarity gained by experience of a fact or situation.

http://en.wikipedia.org/wiki/Knowledge

- Clinical knowledge can take the (executable) form of
  - Taxonomy and classification (clinical coding)
  - Protocols and guidelines
  - Evidence-based Medicine (EBM)
  - Integrated Care Pathways

Clinical information cycles to support quality cycles



Source: NHS Connecting for Health

Foundations of clinical data

Data Types and Formats

In computer programming, a data type (or datatype) is a classification identifying one of various types of data, such as floating-point, integer, or Boolean, stating the possible values for that type, the operations that can be done on that type, and the way the values of that type are stored.

http://en.wikipedia.org/wiki/Data_type

Nineteen primitive types in the XML standard

www.w3.org

- **string**
- **boolean**
- **base64binary**
- **hexBinary**
- **float**
- **decimal**
- **double**
- **anyURI**
- **Qname**
- **NOTATION**
- **duration**
- **dateTime**
- **time**
- **date**
- **gYearMonth**
- **gYear**
- **gMonthDay**
- **gDay**
- **gMonth**

Units of Measurement

The Unified Code for Units of Measure is a code system intended to include all units of measures being contemporarily used in international science, engineering, and business.

The purpose is to facilitate unambiguous electronic communication of quantities together with their units. The focus is on electronic communication, as opposed to communication between humans.

A typical application of The Unified Code for Units of Measure are electronic data interchange (EDI) protocols...

http://unitsofmeasure.org/

Table 26: Example Unit Terms by Term

unit term	suggested alternatives	name or "reading"	example use	canonical form value	canonical form unit
/[arb'U]		per arbitrary unit		1	1
/[HPF]		per high power field		1	1
/[iU]		per international unit		1	1
/{tot}		per total count		1	1
/g{creat}	/g	per gram of creatinine		1	g-1
/g{HGB}	/g	per gram of hemoglobin		1	g-1
/g{tot'nit}	/g	per gram of total nitrogen		1	g-1
/g{tot'ptot}	/g	per gram of total protein		1	g-1
/g{wet'tis}	/g	per gram of wet tissue		1	g-1
/kg		per kilogram		0.001	g-1
/kg{body'wt}	/kg	per kilogram body weight		1000	g-1
/L		per liter		1000	m-3
/m3		per square meter		1	m-3
/min		per minute		0.0166666666666667	s-1
/mL		per milliliter		1000000	m-3
/mL		per milliliter		1000000	m-3

Example from HL7 v2.4

for clinical messaging

Data Constraints

- There may be constraints on the values data items can take, or between data items
  - Which arguably turns these data into information, or even knowledge
- For example
  - Age measured in years, must be a positive integer
  - Age can be derived from Date of Birth and Current Date
  - If sex is 'male' then surgical procedure cannot be hysterectomy

Data Properties

- As well as data type, units and constraints, the set of properties we may want to model in a clinical data item include

  data type
  units of measurement
  constraints
  plausible range (including list of enumerated values)
  occurrence
  optional/required
  clinical coding
  conditions of applicability
  calculated value (how is it derived from others)
  default value
  pre-filled (initial) value
  reference range

Data Behaviour

- Data items may also display certain behaviour when users interact with them
- Including different behaviour depending on the user and the clinical context

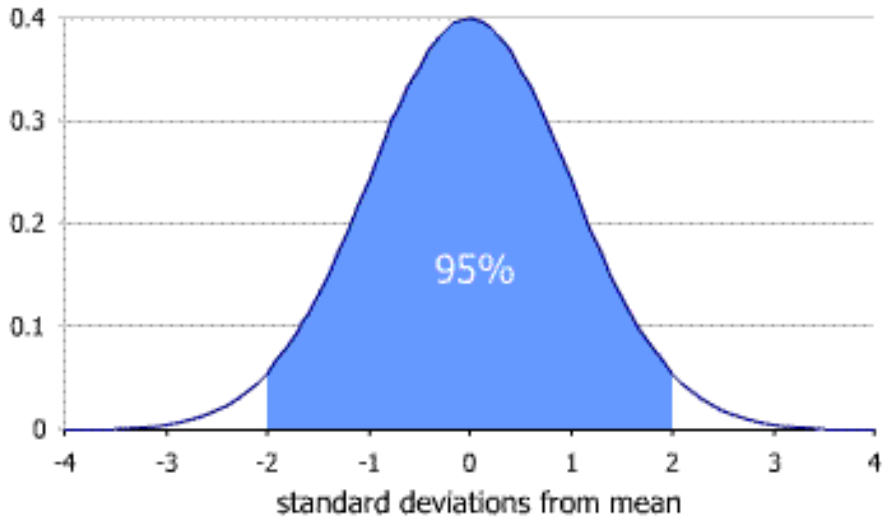
format (of display/presentation)
    including media for display
method of entry
    e.g. date picker, autocomplete, drop-down
collation (sort order)
categorisation
CRUD
    create, read, update, delete
optional/required (might be considered a property)

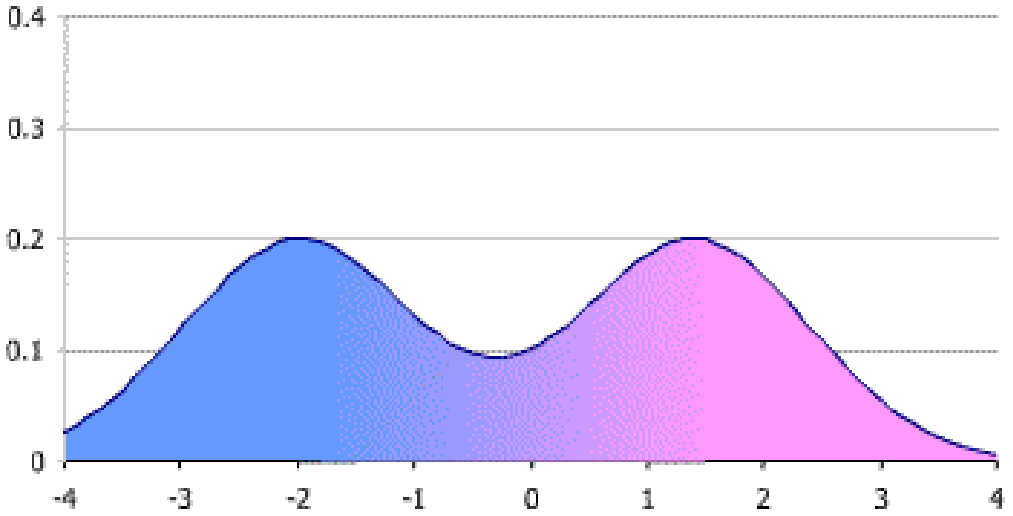
Reference Ranges

In health-related fields, a reference range (or reference values or interval) is a set of values of some measurement that a physician or other health professional can use to interpret a set of results for a particular patient. It is determined by collecting data from vast numbers of laboratory tests.

A reference range for a particular test or measurement, is usually defined as the prediction interval of values that 95% (or 2 standard deviations) of the population fall into. It relies on the fact that for many biological phenomena, there is a normal distribution of values.

http://en.wikipedia.org/wiki/Reference_ranges





Clinical Data Sets

Today, much electronic patient information is available in operational data systems (for example, laboratory systems, pharmacy systems, and surgical scheduling systems) and is accessible by agencies and organizations through standards for messages, codes, and encrypted electronic mail.

Such agencies and organizations should define the elements of their data sets in terms of standardized operational data, and data producers should fully adopt these code and message standards.

McDonald et al [8]

- Clinical Data Sets for
  - Collection of patient information
  - Order sets
  - Results sets
  - Medications (formulary)

Clinical Data Sets in the NHS

The development of data sets supports:

- information requirements of national and local performance management, planning and clinical governance
- assurance of the quality of health and social care services
- the monitoring of National Service Frameworks (NSFs)

The information in the Clinical Data Sets is transmitted at patient level.

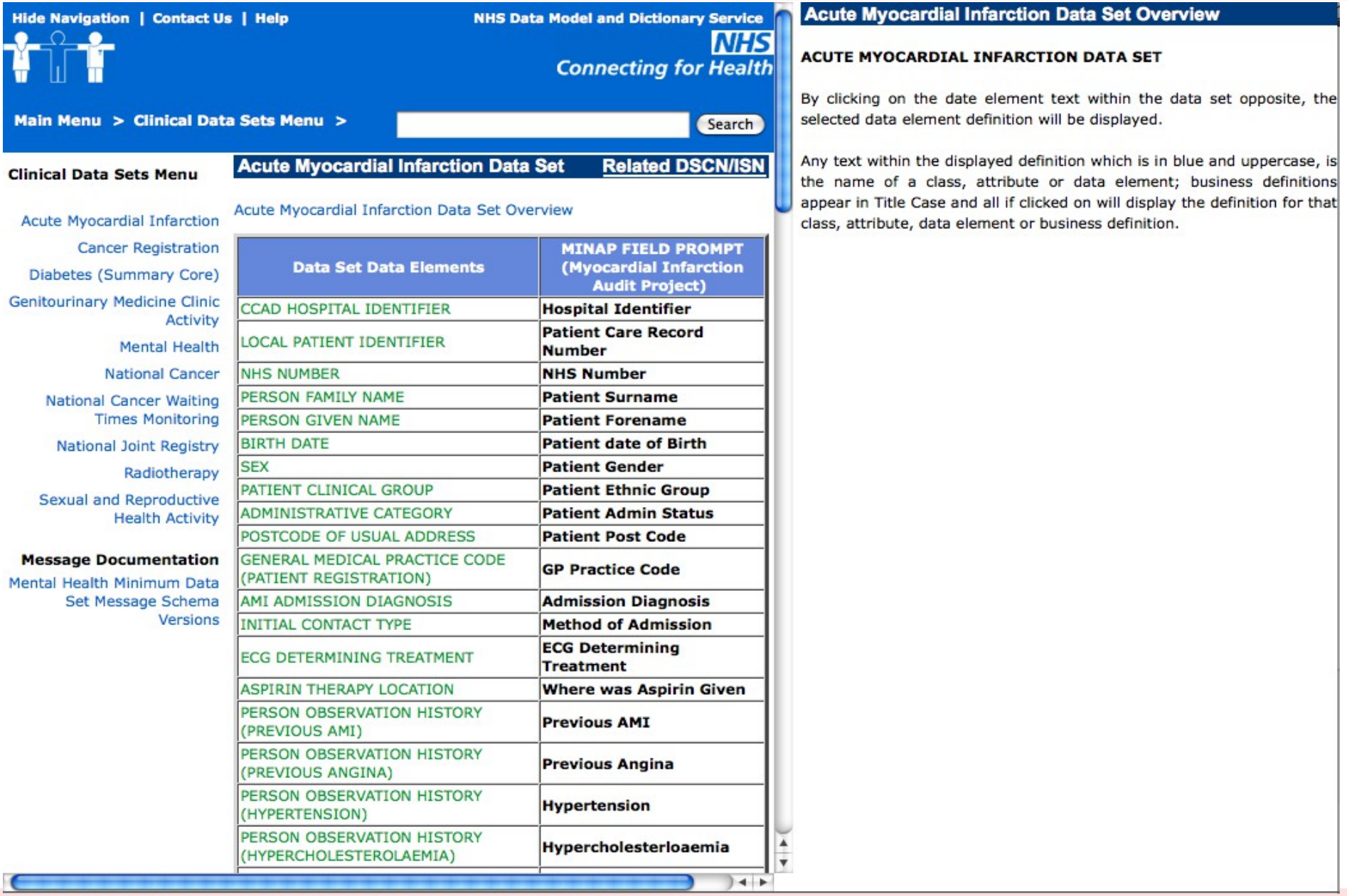
http://www.datadictionary.nhs.uk/web_site_content/navigation/clinical_data_sets_menu.asp

Use the URL above to access the lists and screen shots on the following slides, retrieved October 2010.

Coverage of NHS Data Sets

- Acute Myocardial Infarction
- Cancer Registration
- Diabetes (Summary Core)
- Genitourinary Medicine Clinic Activity
- Mental Health
- National Cancer
- National Cancer Waiting Times Monitoring
- National Joint Registry
- Radiotherapy
- Sexual and Reproductive Health Activity

Example of an NHS Data Set



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NHS Data Model and Dictionary Service

NHS Connecting for Health

Main Menu > Clinical Data Sets Menu > Search

Clinical Data Sets Menu

- Acute Myocardial Infarction
- Cancer Registration
- Diabetes (Summary Core)
- Genitourinary Medicine Clinic Activity
- Mental Health
- National Cancer
- National Cancer Waiting Times Monitoring
- National Joint Registry
- Radiotherapy
- Sexual and Reproductive Health Activity

Message Documentation

- Mental Health Minimum Data Set Message Schema Versions

Acute Myocardial Infarction Data Set | **Related DSCN/ISN**

Acute Myocardial Infarction Data Set Overview

Data Set Data Elements	MINAP FIELD PROMPT (Myocardial Infarction Audit Project)
CCAD HOSPITAL IDENTIFIER	**Hospital Identifier**
LOCAL PATIENT IDENTIFIER	**Patient Care Record Number**
NHS NUMBER	**NHS Number**
PERSON FAMILY NAME	**Patient Surname**
PERSON GIVEN NAME	**Patient Forename**
BIRTH DATE	**Patient date of Birth**
SEX	**Patient Gender**
PATIENT CLINICAL GROUP	**Patient Ethnic Group**
ADMINISTRATIVE CATEGORY	**Patient Admin Status**
POSTCODE OF USUAL ADDRESS	**Patient Post Code**
GENERAL MEDICAL PRACTICE CODE (PATIENT REGISTRATION)	**GP Practice Code**
AMI ADMISSION DIAGNOSIS	**Admission Diagnosis**
INITIAL CONTACT TYPE	**Method of Admission**
ECG DETERMINING TREATMENT	**ECG Determining Treatment**
ASPIRIN THERAPY LOCATION	**Where was Aspirin Given**
PERSON OBSERVATION HISTORY (PREVIOUS AMI)	**Previous AMI**
PERSON OBSERVATION HISTORY (PREVIOUS ANGINA)	**Previous Angina**
PERSON OBSERVATION HISTORY (HYPERTENSION)	**Hypertension**
PERSON OBSERVATION HISTORY (HYPERCHOLESTEROLAEMIA)	**Hypercholesterloaemia**

Acute Myocardial Infarction Data Set Overview

ACUTE MYOCARDIAL INFARCTION DATA SET

By clicking on the date element text within the data set opposite, the selected data element definition will be displayed.

Any text within the displayed definition which is in blue and uppercase, is the name of a class, attribute or data element; business definitions appear in Title Case and all if clicked on will display the definition for that class, attribute, data element or business definition.

Data Item - Description

PERSON FAMILY NAME Related DSCN/ISN

Description | **Where Used**

Format/length:	max 35 characters
HES item:	
National Codes:	
Default Codes:	

Notes:
That part of a PERSON's name which is used to describe family, clan, tribal group, or marital association.

PERSON FAMILY NAME is the same as PERSON NAME WORD TEXT where the PERSON NAME WORD TYPE equals *'b. Person Family Name'*.

This is the e-Government Interoperability Framework (e-GIF) standard that should be used for all new and developing systems and for XML messages.

References:
The e-GIF version approved for use in NHS England is:
Government Data Standards Catalogue: (GDSC), Version 2.0, Agreed 1 January 2002.
GDSC: http://www.cabinetoffice.gov.uk/govtalk/schemasstandards/e-gif/datastandards.aspx.

This data element is also known by these names:

Context	Alias
formerly	PATIENT FAMILY OR SURNAME
plural	PERSON FAMILY NAMES

Data Item – Where Used

PERSON FAMILY NAME — Related DSCN/ISN

Description | Where Used

Where used:

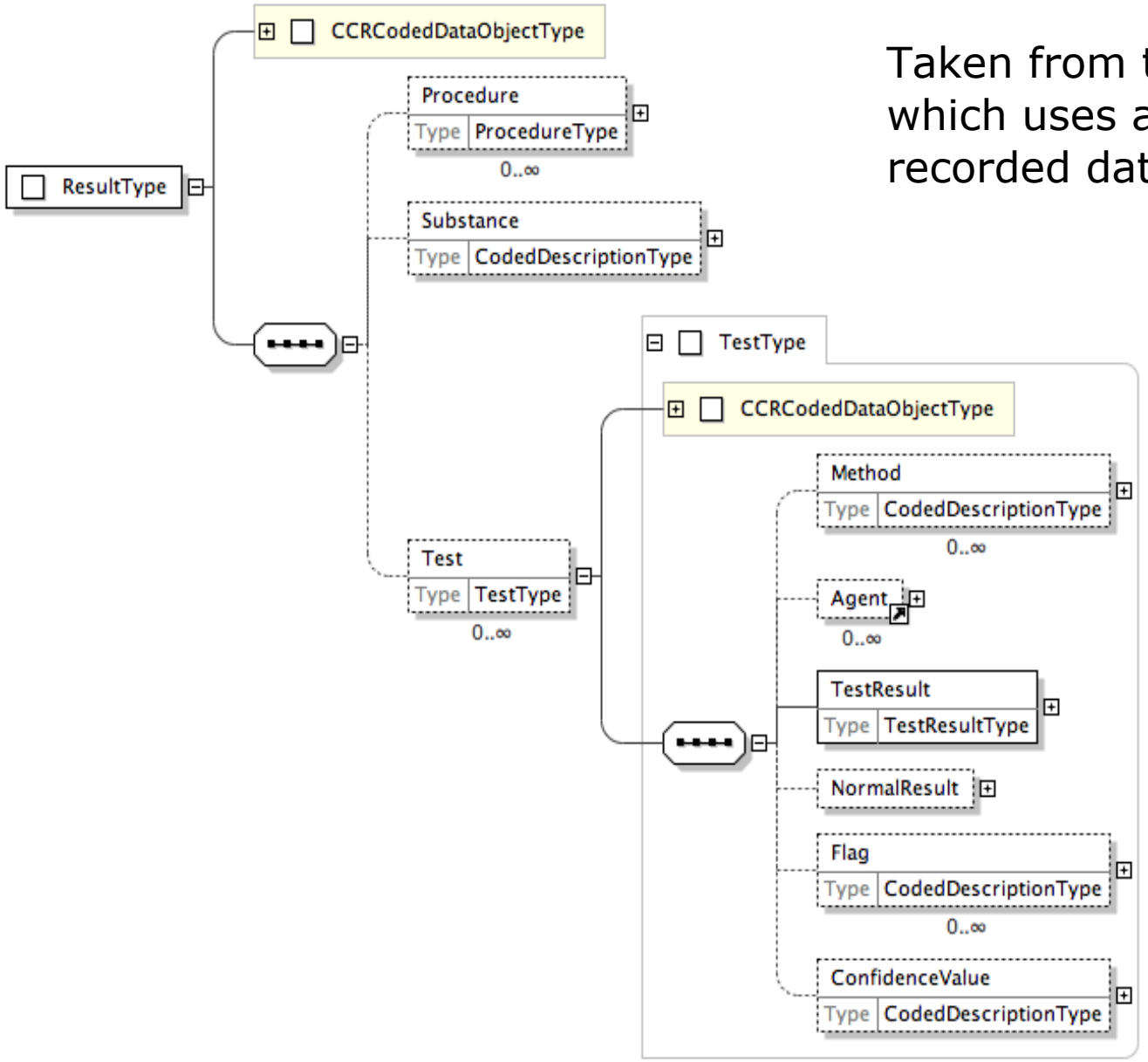
Data Set	Acute Myocardial Infarction Data Set	references in description PERSON FAMILY NAME
Data Set	Cancer Registration Data Set	references in description PERSON FAMILY NAME
Data Set	Inter-Provider Transfer Administrative Minimum Data Set	references in description PERSON FAMILY NAME
Data Set	National Cancer Data Set	references in description PERSON FAMILY NAME
Data Set	National Joint Registry Data Set	references in description PERSON FAMILY NAME
Data Set	National Workforce Data Set	references in description PERSON FAMILY NAME
Data Element	FAMILY OR SURNAME OF RELATION WITH CANCER	references in description PERSON FAMILY NAME
Data Element	PERSON FAMILY NAME	references in description PERSON FAMILY NAME
Data Element	PERSON FAMILY NAME (AT BIRTH)	references in description PERSON FAMILY NAME
Data Element	PERSON FULL NAME	references in description PERSON FAMILY NAME
Data Element	PERSON FULL NAME (CLINICAL SUPERVISOR LATEST)	references in description PERSON FAMILY NAME
Data Element	PERSON FULL NAME (EDUCATIONAL SUPERVISOR LATEST)	references in description PERSON FAMILY NAME

Model for a Data Item

Taken from cityEHR which uses HL7 CDA as its representation for recorded data.


```
<entry cityEHR:layout="Unranked" cityEHR:rendition="#CityEHR:EntryProperty:Form" cityEHR:initialValue="#CityEHR:EntryProperty:Default"
cityEHR:labelWidth="27" cityEHR:conditions="" cityEHR:visibility="">
                    <observation>
                      <typeid root="cityEHR" extension="#HL7-CDA:Observation"/>
                      <id root="#ISO-13606:Entry:CigarettesPerDay" extension="#ISO-13606:Entry:CigarettesPerDay" cityEHR:origin=""/>
                      <code code="xxxx" codeSystem="2.16.840.1.113883.2.1.3.2.4.15" displayName="How many cigarettes per day"/>
                      <value root="#ISO-13606:Element:NumberPerDay" extension="#ISO-13606:Element:NumberPerDay"
xsi:type="xs:integer" value="" units="" code="" codeSystem="" displayName="" cityEHR:elementDisplayName=""
cityEHR:elementType="#CityEHR:ElementProperty:simpleType" cityEHR:valueRequired="#CityEHR:ElementProperty:Optional"
cityEHR:fieldLength="3" cityEHR:elementScope="#CityEHR:ElementProperty:Defined" cityEHR:defaultValue="10"/>
                    </observation>
</entry>
```

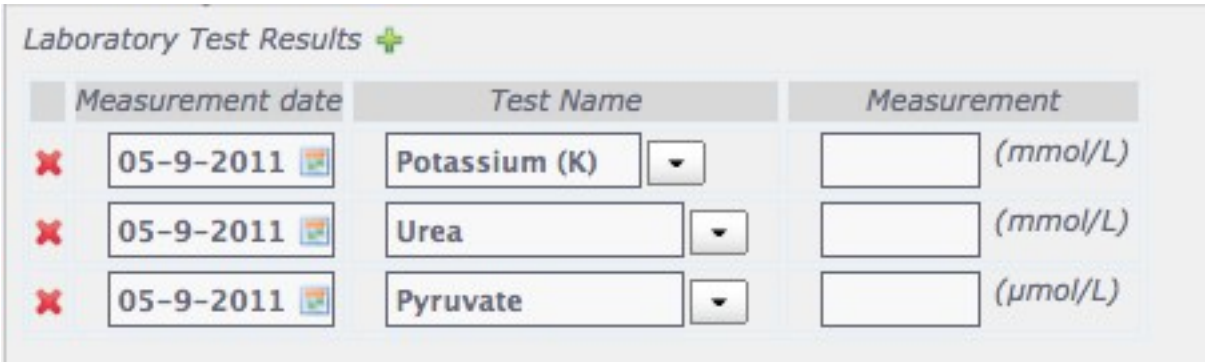
Model for a Laboratory Test Result



Taken from the Continuity of Care Record which uses an XML representation for recorded data.

Model for a Laboratory Test Result

Taken from cityEHR which uses HL7 CDA as its representation for recorded data.




```
<observation>
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                    <id root="#ISO-13606:Entry:LabResults" extension="#ISO-13606:Entry:LabResults" cityEHR:origin=""/>
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                    <value root="#ISO-13606:Element:MeasurementDate" extension="#ISO-13606:Element:MeasurementDate"
xsi:type="xs:date" value="" units="" code="" codeSystem="" displayName="" cityEHR:elementDisplayName="Measurement date"
cityEHR:elementType="#CityEHR:ElementProperty:simpleType" cityEHR:valueRequired="#CityEHR:ElementProperty:Optional"
cityEHR:elementScope="#CityEHR:ElementProperty:Defined" cityEHR:defaultValue="current-date()"/>
                    <value root="#ISO-13606:Element:LabTest" extension="#ISO-13606:Element:LabTest" xsi:type="xs:string"
value="" units="" code="" codeSystem="" displayName="" cityEHR:elementDisplayName="Test Name"
cityEHR:elementType="#CityEHR:ElementProperty:enumeratedClass"
cityEHR:valueRequired="#CityEHR:ElementProperty:Optional" cityEHR:elementScope="#CityEHR:ElementProperty:Defined"
orchid:coreDataSet="" cityEHR:elementControlId=""/>
                    <value root="#ISO-13606:Element:LabTestResult" extension="#ISO-13606:Element:LabTestResult"
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cityEHR:elementType="#CityEHR:ElementProperty:simpleType" cityEHR:valueRequired="#CityEHR:ElementProperty:Optional"
cityEHR:fieldLength="6" cityEHR:elementScope="#CityEHR:ElementProperty:Defined" cityEHR:calculatedUnit="#ISO-
13606:Element:LabTest"/>
</observation>
```
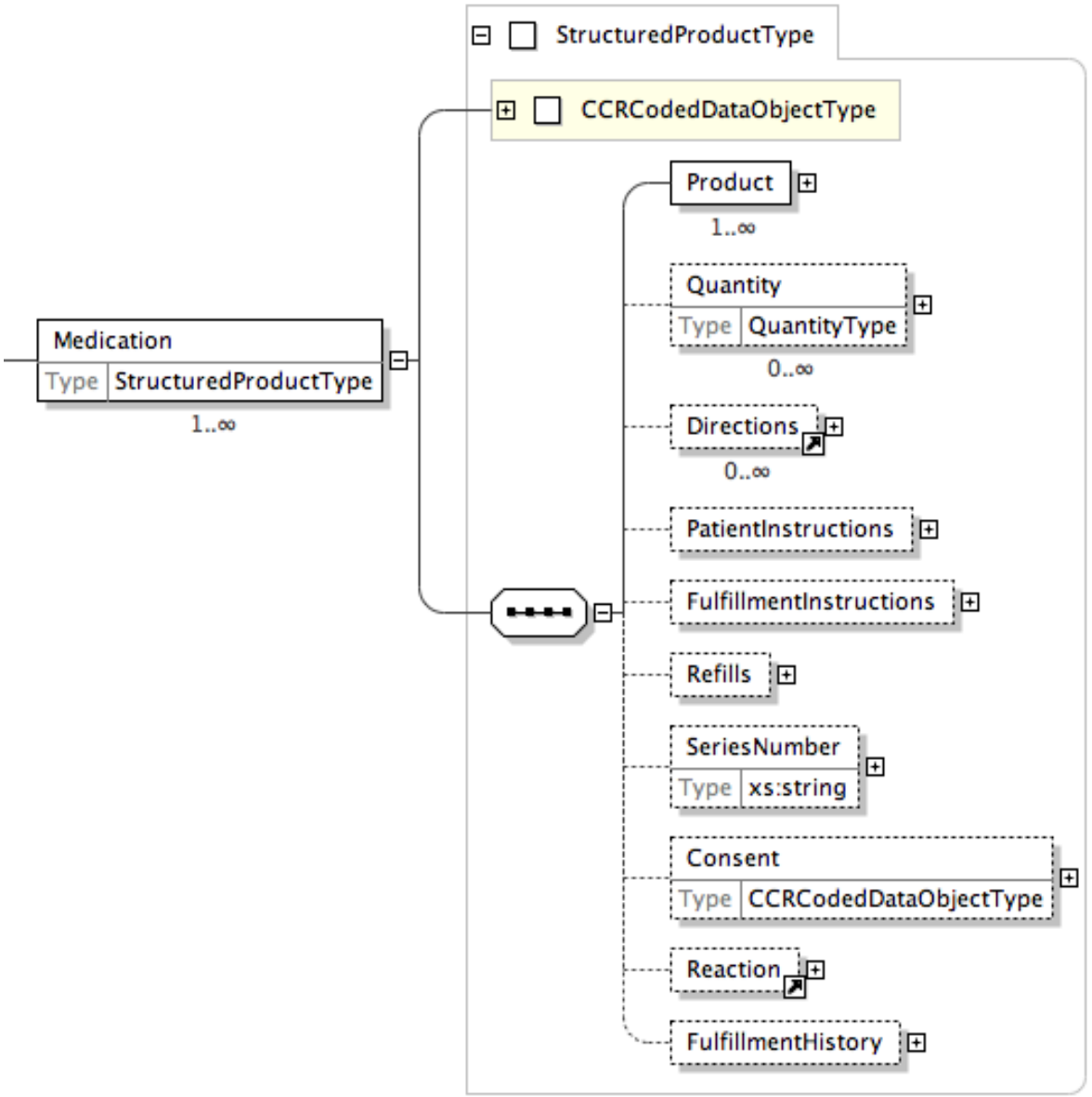
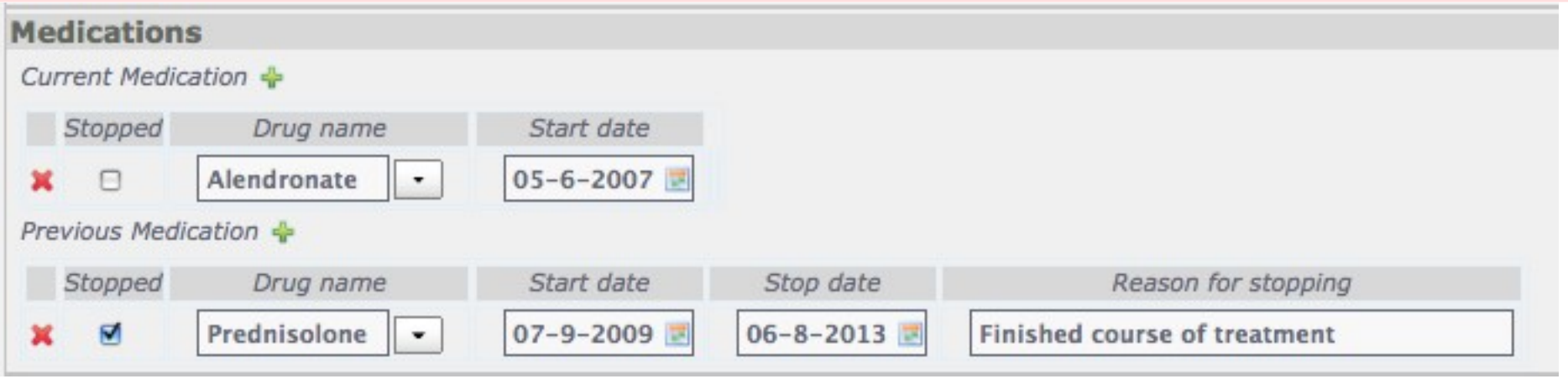

Model for Medication



Taken from the Continuity of Care Record which uses an XML representation for recorded data.

Model for Medication




```
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                    <value root="#ISO-13606:Element:DrugStopped" extension="#ISO-13606:Element:DrugStopped" xsi:type="xs:boolean" value="false"
units="" code="" codeSystem="" displayName="" cityEHR:elementDisplayName="Stopped" cityEHR:elementType="#CityEHR:ElementProperty:simpleType"
cityEHR:valueRequired="#CityEHR:ElementProperty:Optional" cityEHR:elementScope="#CityEHR:ElementProperty:Defined"/>
                    <value root="#ISO-13606:Element:DrugName" extension="#ISO-13606:Element:DrugName" xsi:type="xs:string" value="" units=""
code="" codeSystem="" displayName="" cityEHR:elementDisplayName="Drug name" cityEHR:elementType="#CityEHR:ElementProperty:enumeratedClass"
cityEHR:valueRequired="#CityEHR:ElementProperty:Optional" cityEHR:elementScope="#CityEHR:ElementProperty:Defined" orchid:coreDataSet=""
cityEHR:elementControlId=""/>
                    <value root="#ISO-13606:Element:StartDate" extension="#ISO-13606:Element:StartDate" xsi:type="xs:date" value="" units="" code=""
codeSystem="" displayName="" cityEHR:elementDisplayName="Start date" cityEHR:elementType="#CityEHR:ElementProperty:simpleType"
cityEHR:valueRequired="#CityEHR:ElementProperty:Optional" cityEHR:elementScope="#CityEHR:ElementProperty:Defined" cityEHR:defaultValue="current-
date()"/>
                    <value root="#ISO-13606:Element:StopDate" extension="#ISO-13606:Element:StopDate" xsi:type="xs:date" value="" units="" code=""
codeSystem="" displayName="" cityEHR:elementDisplayName="Stop date" cityEHR:elementType="#CityEHR:ElementProperty:simpleType"
cityEHR:valueRequired="#CityEHR:ElementProperty:Optional" cityEHR:elementScope="#CityEHR:ElementProperty:Defined" cityEHR:conditions=""
cityEHR:visibility=""/>
                    <value root="#ISO-13606:Element:StoppingReason" extension="#ISO-13606:Element:StoppingReason" xsi:type="xs:string" value=""
units="" code="" codeSystem="" displayName="" cityEHR:elementDisplayName="Reason for stopping"
cityEHR:elementType="#CityEHR:ElementProperty:simpleType" cityEHR:valueRequired="#CityEHR:ElementProperty:Optional"
cityEHR:elementScope="#CityEHR:ElementProperty:Defined" cityEHR:conditions="" cityEHR:visibility=""/>
 </observation>
```

Patient data and clinical records

Contents of a Clinical Record

Clinical Correspondence
Referral letters
Discharge summaries
Clinic letters

Medical History
Surgical history
Obstetric history
Allergies
Medications
Family history
Social history
Habits
Immunisation history
Growth chart and development history

Orders and Prescriptions
Lab (Pathology) tests
Radiology (images)
Drug prescriptions
Ancillary services

Test Results
Lab test results
Diagnostic images
(Radiology reports)

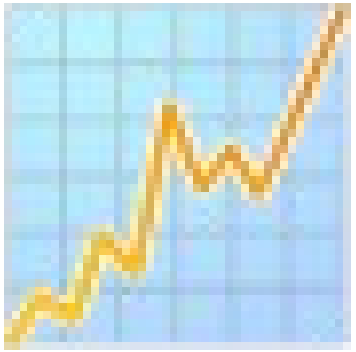
Demographics
Patient identifiers
Name
Address
Sex
Ethnicity
Religion
Occupation
Next of kin
Primary care physician

Medical Encounters
Complaint
History of current illness
Physical examination
Assessment and plan

Progress Notes
Daily updates on patient condition during a period of hospitalisation

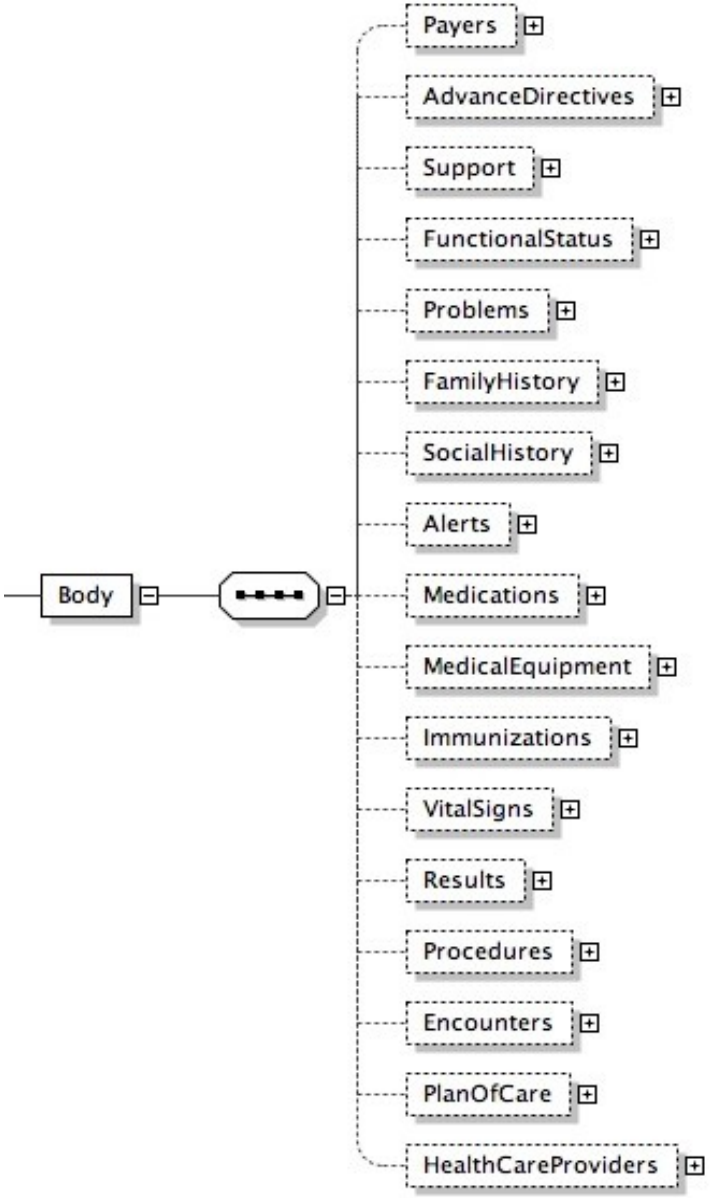
Transient Clinical Data

- Some patient information is recorded and stored only for a short time in a clinical record
  - Vital Signs: Body Temperature, Pulse Rate(Heart Rate), Blood Pressure and Respiratory Rate.
  - Intake: Medication, Fluid, Nutrition, Water and Blood, etc.
  - Output: Blood, Urine, Excrement, Vomitus and Sweat, etc.
  - Observation on Pupil size.
  - Capability of four limbs of body



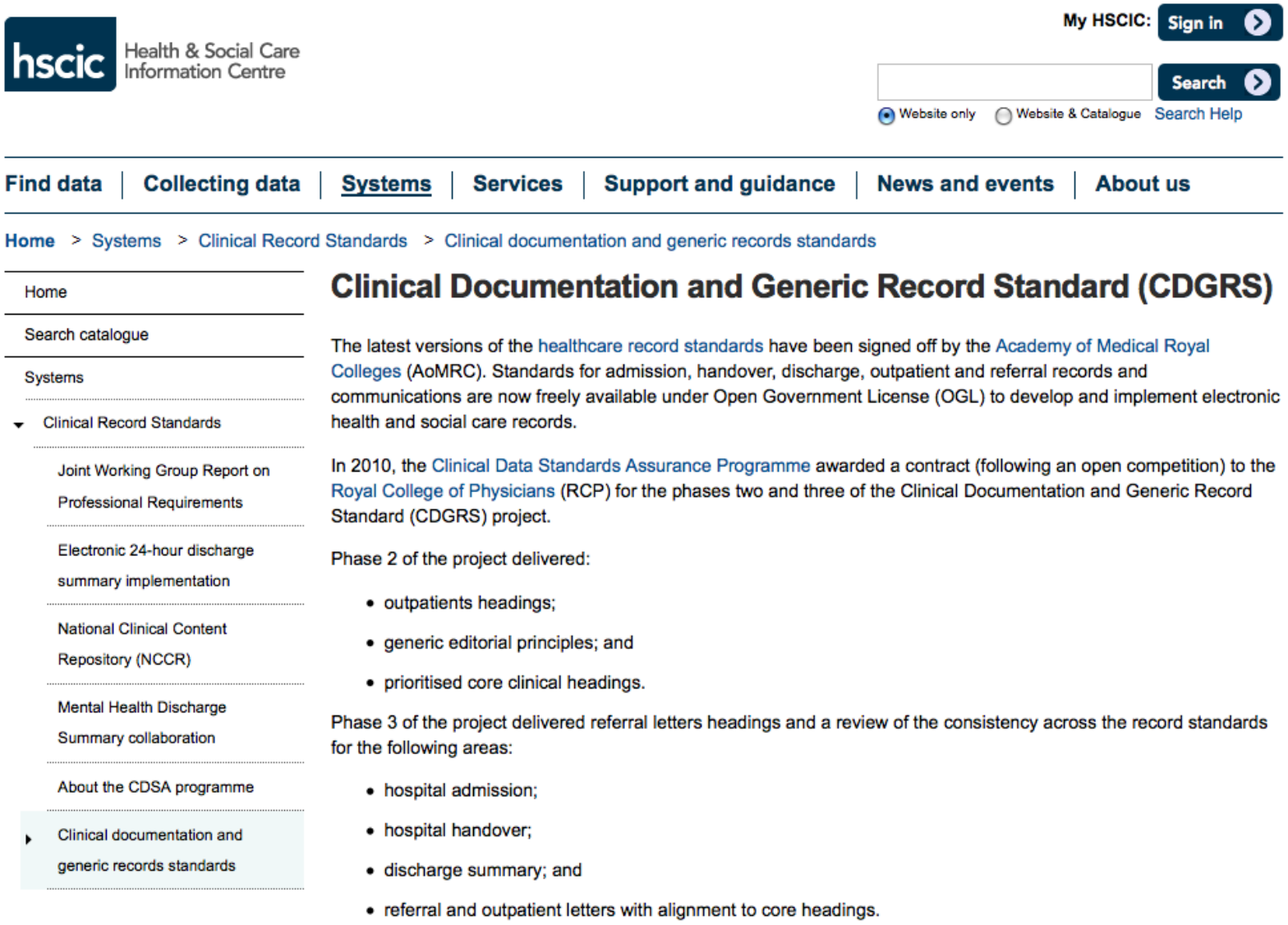
Source: http://en.wikipedia.org/wiki/Medical_record

CCR – Record Sections



The main body of the clinical record in CCR consists of 17 sections

Clinical Documentation and Generic Record Standard (CDGRS)



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    - Mental Health Discharge Summary collaboration
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    - Clinical documentation and generic records standards

Clinical Documentation and Generic Record Standard (CDGRS)

The latest versions of the healthcare record standards have been signed off by the Academy of Medical Royal Colleges (AoMRC). Standards for admission, handover, discharge, outpatient and referral records and communications are now freely available under Open Government License (OGL) to develop and implement electronic health and social care records.

In 2010, the Clinical Data Standards Assurance Programme awarded a contract (following an open competition) to the Royal College of Physicians (RCP) for the phases two and three of the Clinical Documentation and Generic Record Standard (CDGRS) project.

Phase 2 of the project delivered:

- outpatients headings;
- generic editorial principles; and
- prioritised core clinical headings.

Phase 3 of the project delivered referral letters headings and a review of the consistency across the record standards for the following areas:

- hospital admission;
- hospital handover;
- discharge summary; and
- referral and outpatient letters with alignment to core headings.

Source: http://systems.hscic.gov.uk/clinrecords/cdgrs

Logical Record Architecture

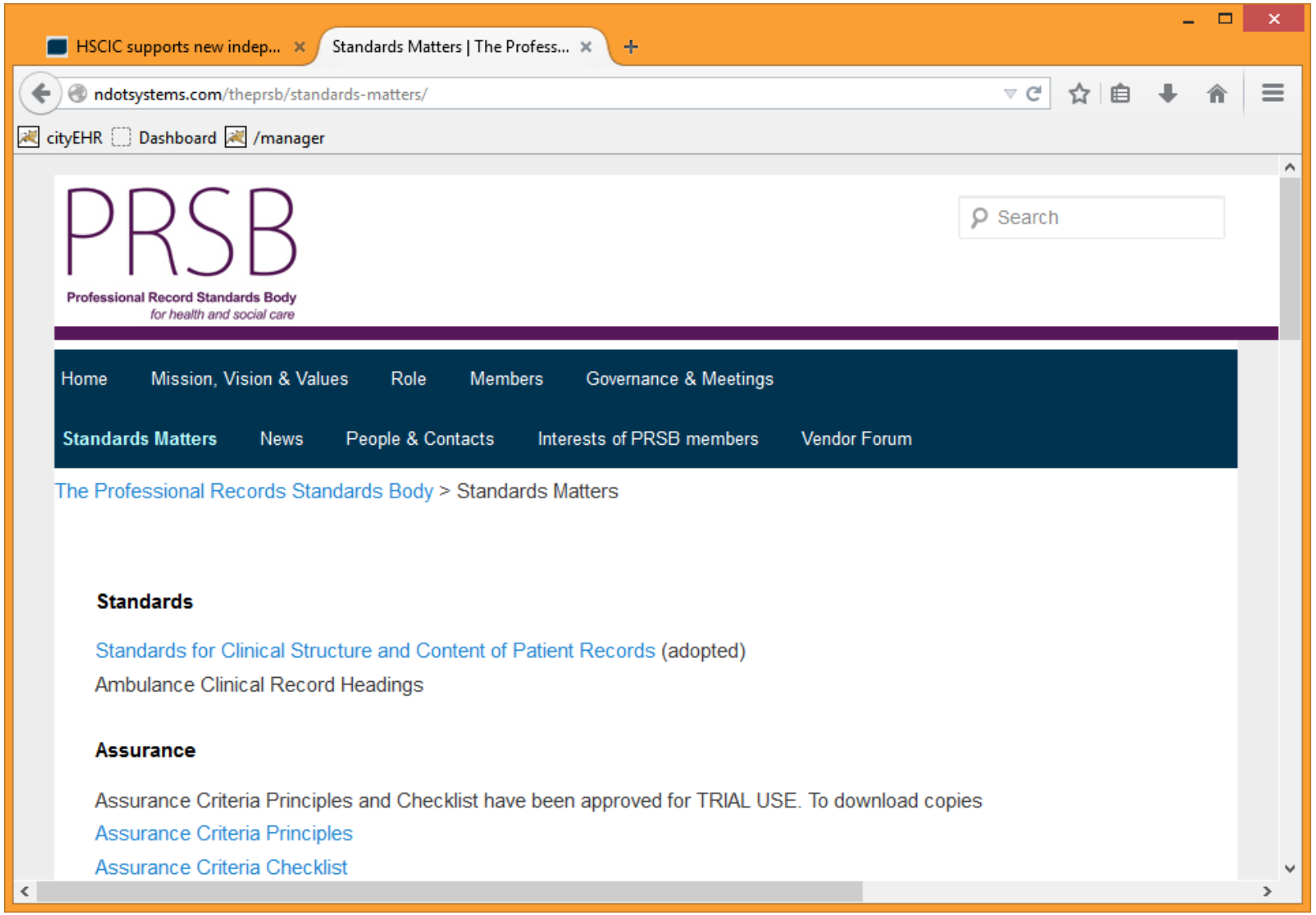
Logical Record Architecture for Health and Social Care.

The LRA was established as part of the informatics data standards programme set up following the publication of High Quality Care For All, the Next Stage Review final report by Lord Darzi and the Health Informatics Review Report.

The LRA is designed to allow better information sharing. It describes what data should be shared across multiple applications and how data will be managed, accessed and interpreted between independent information systems.

Source: http://www.connectingforhealth.nhs.uk/systemsandservices/data/lra

Professional Records Standards Body



Source:http://www.theprsb.org.uk

Information Model of the LRA

The Logical Record Architecture for health and social care uses the normative parts of BS EN 13606-1:2007 - "Health informatics. Electronic health record communication. Reference model."

BS EN 13606-1 is a European standard that aims to define a rigorous and stable information architecture for communicating part or all of the Electronic Health Record (EHR) of a single subject of care (patient).

This is to support the interoperability of systems and components that need to communicate (access, transfer, add or modify) EHR data via electronic messages or as distributed objects:

- Preserving the original clinical meaning intended by the author
- Reflecting the confidentiality of that data as intended by the author and patient.

It may also be used for EHR communication between an EHR system or repository and clinical applications or middleware components (such as decision support components) that need to access or provide EHR data.

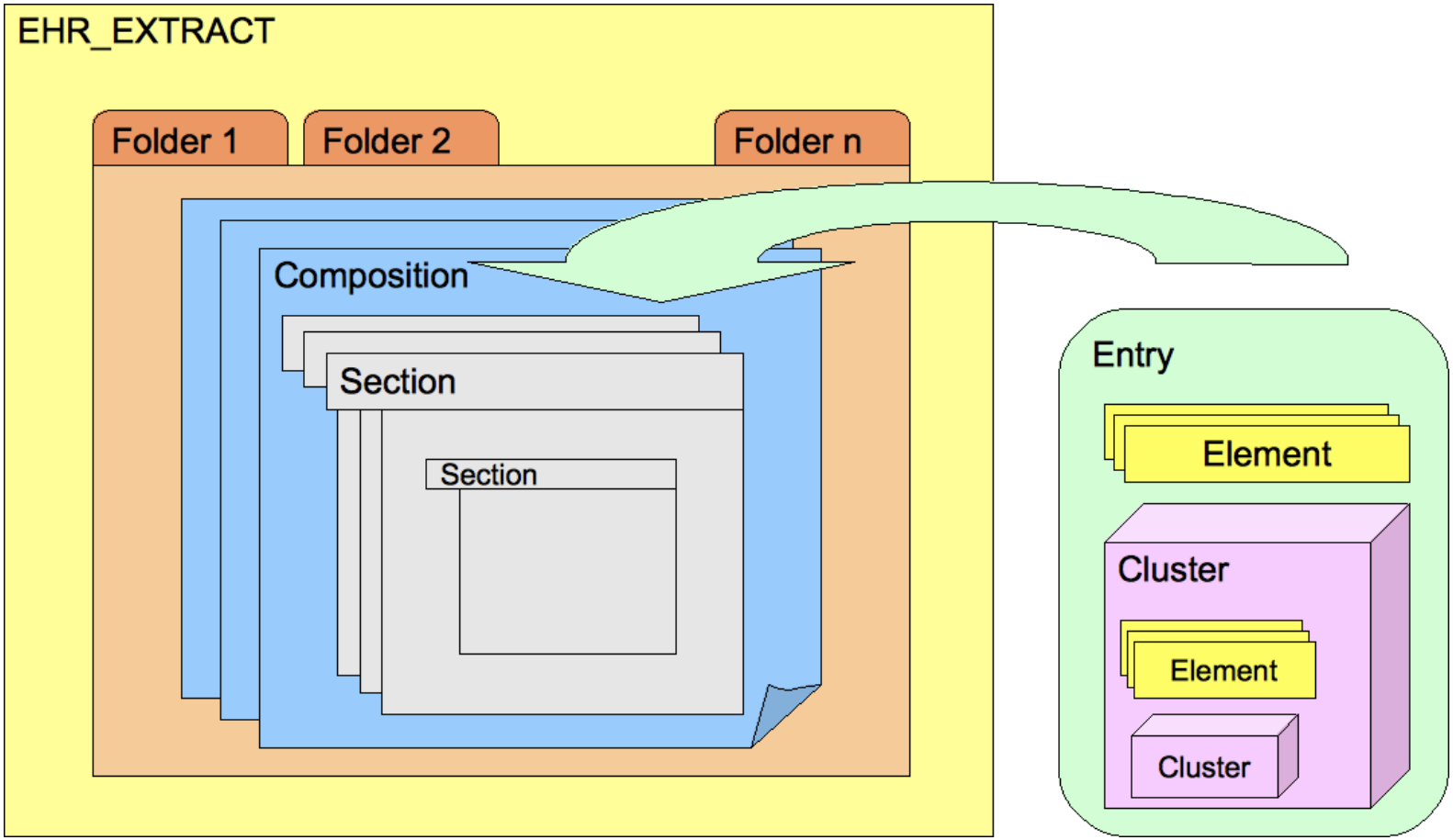
Source: http://www.connectingforhealth.nhs.uk/systemsandservices/data/lra/international

EN 13606 and OpenEHR

For further information on EN 13606, see http://www.en13606.org/

The openEHR Framework is the basis of this new Electronic Health Record Communication Standard (EN 13606).

http://en.wikipedia.org/wiki/EN_13606



OpenEHR

The principal challenge for health ICT is to represent the semantics of the sector, which are far more complex than in other industries.

Doing this requires a knowledge-oriented computing framework that includes ontologies, terminology and a semantically enabled health computing platform in which complex meaning can be represented and shared.

At the same time it must support the economically viable construction of maintainable and adaptable health computing systems and patient-centric electronic health records (EHRs).

Technically, openEHR is about creating specifications, open source software and tools for such a platform.

In the clinical space, it is about creating high-quality, re-usable clinical models of content and process - known as archetypes - along with formal interfaces to terminology.

http://www.openEHR.org

OpenEHR - Archetypes

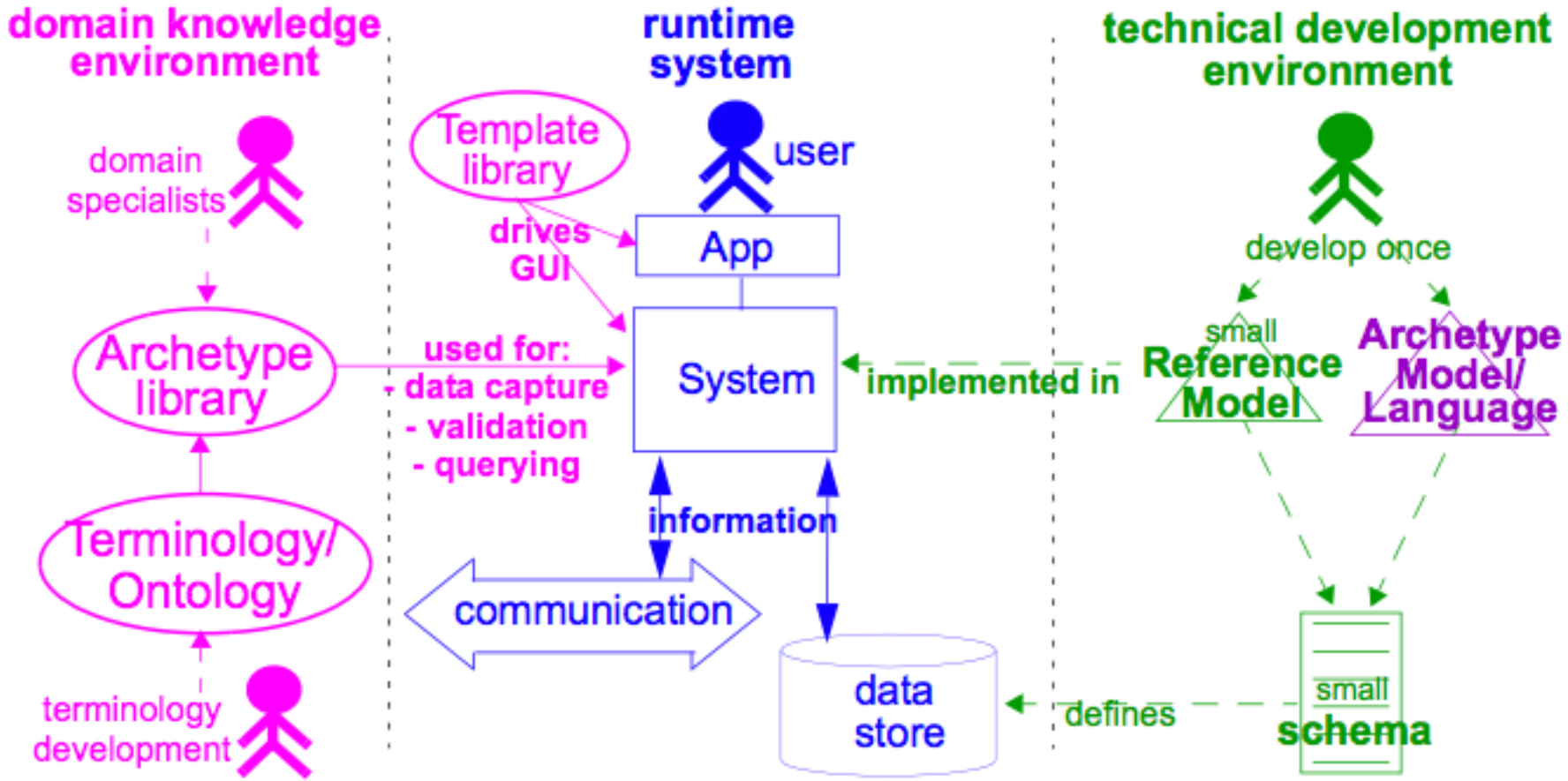
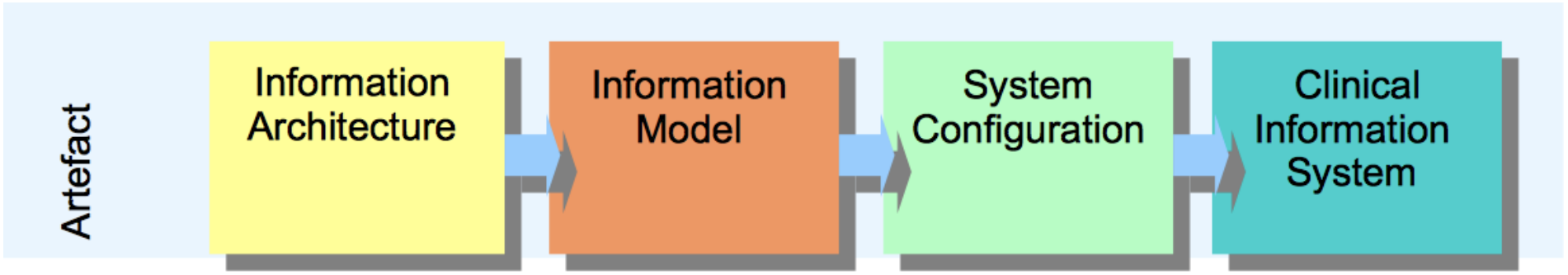


FIGURE 6 Two-level Software Engineering

Beale T, Heard S (eds). OpenEHR Architecture Overview. The OpenEHR Foundation. Available from http://www.openehr.org

The cityEHR Modelling Process

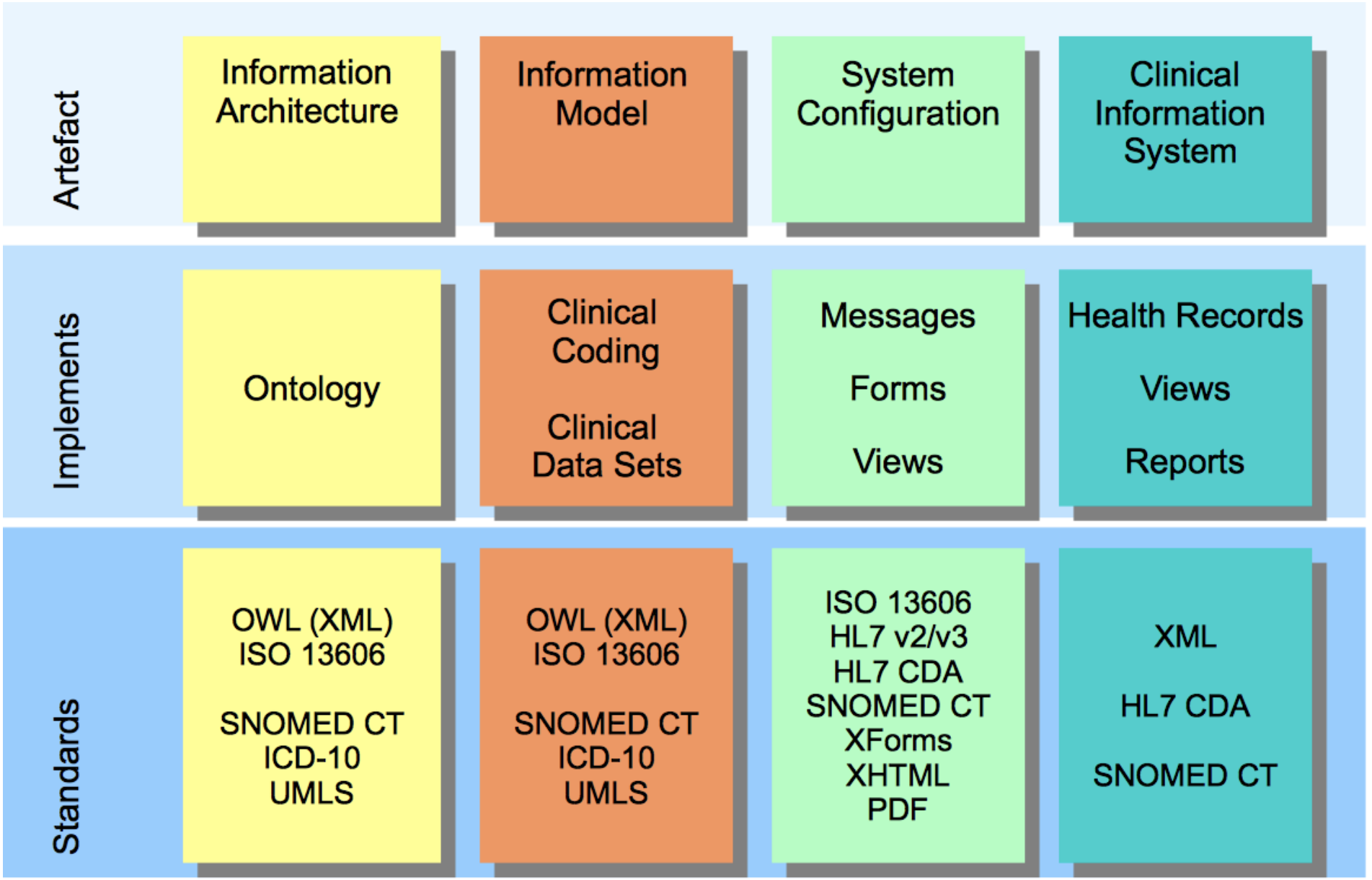


http://openhealthinformatics.org

Four stage modelling process

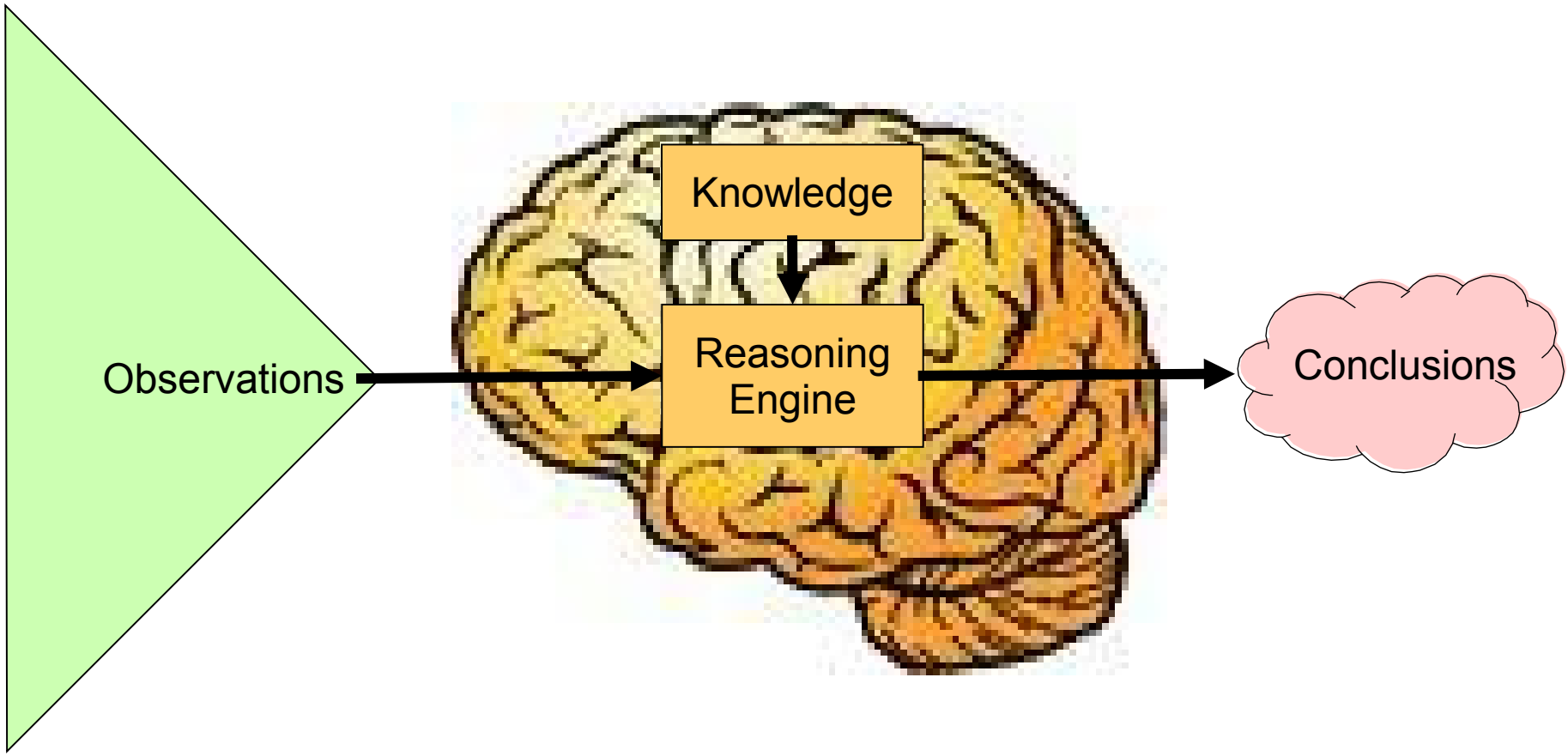
- Information Architecture ensures that all models are consistent and can interoperate
- Information model allows each application to model healthcare data in the most appropriate way, based on the application requirements
- System Confirguration is generated automatically from the model and is optimised for the runtime EHR system
- Clinical Information System stores and manipulates data based on standards that allow interchange with any EHR system

Detail of cityEHR Modelling Process



Information and knowledge for clinical decisions

How Knowledge Fuels Reasoning



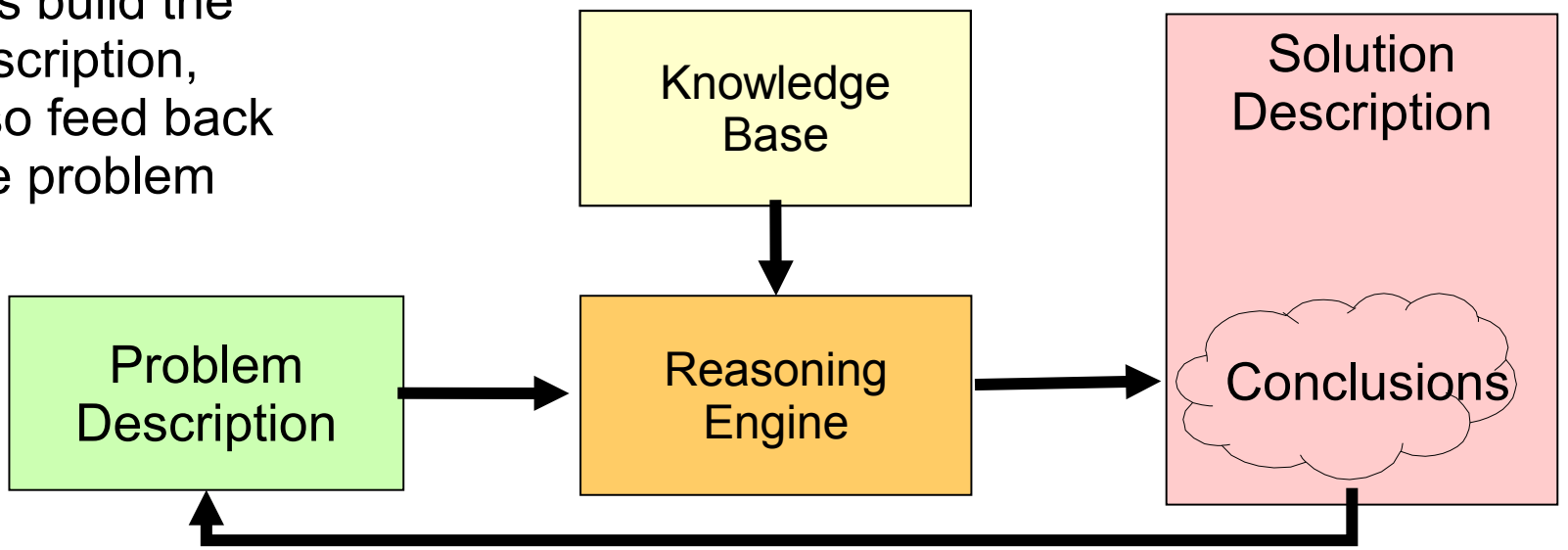
- Observations provide information on current context (problem)
- Knowledge base and observations are inputs to a reasoning engine
- Reasoning engine generates conclusions relevant to current context, based on observations and knowledge

Reasoning Engine

A reasoning engine is a computer program that tries to derive answers from a knowledge base.

It is the “brain” that knowledge based systems use to reason about the information in the knowledge base, for the ultimate purpose of formulating new conclusions.

Conclusions build the solution description, but may also feed back to refine the problem description



Knowledge Based Systems

A knowledge based system, is a computer program that contains some of the subject-specific knowledge of one or more human experts

- The principal distinction between knowledge based systems and traditional problem solving programs is the way in which the problem related expertise (knowledge) is coded

procedural

- In traditional applications, problem expertise is encoded in both program and data structures.

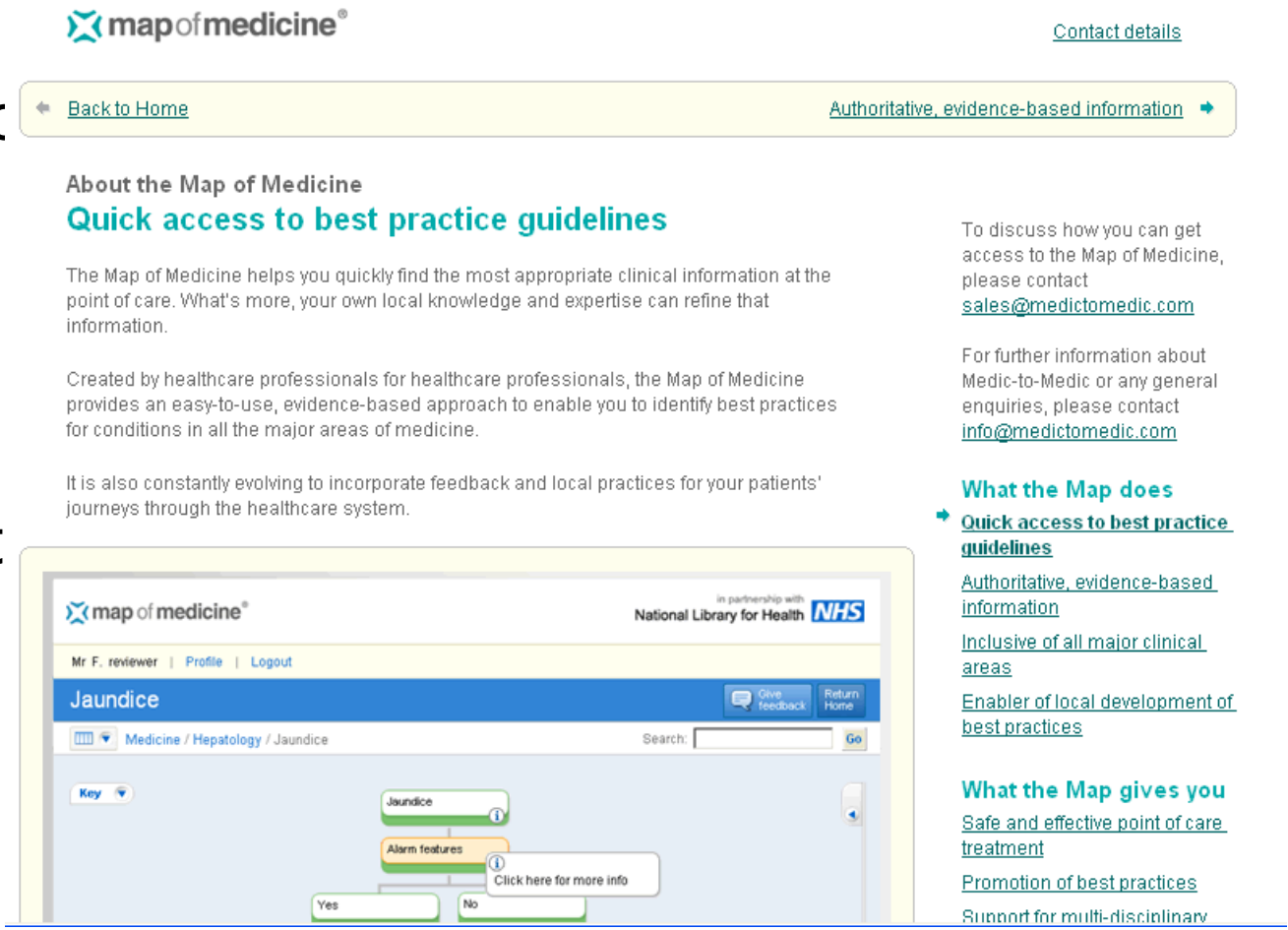
- In knowledge based systems all of the problem related expertise is encoded in data structures only; none is in programs

declarative

Map of Medicine

http://www.mapofmedicine.com/

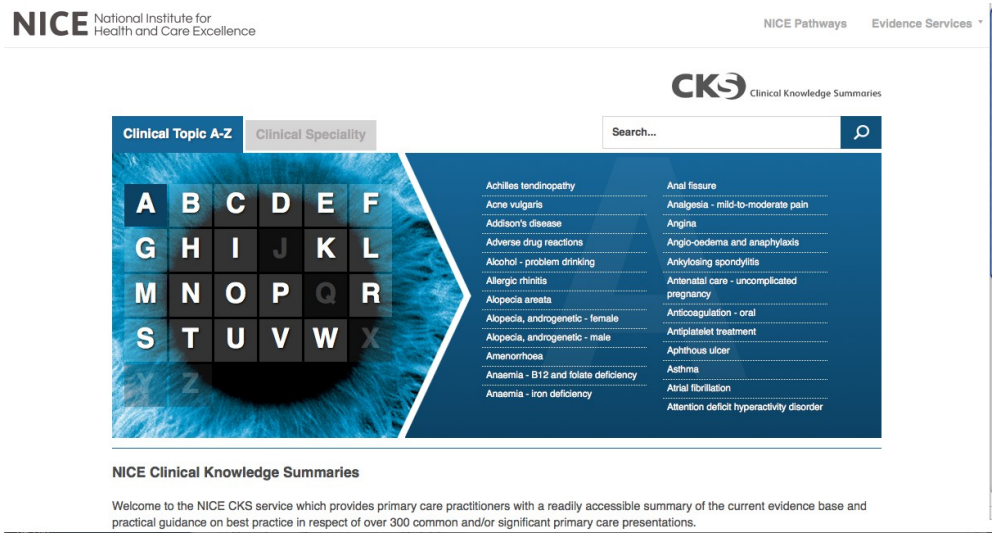
- Developed by medic-tc medic, now owned by Informa Healthcare
- Over 250 'patient journeys' mapping out the steps to be taken by clinicians



NHS Clinical Summaries (PRODIGY)

http://www.cks.nhs.uk

- Sowerby Centre for Health Informatics at Newcastle (SCHIN) developed, and keeps up-to-date, around 170 guidance topics for both acute and chronic illnesses
- PRODIGY guidance offers advice on the management of conditions and symptoms that are commonly seen in primary care.
- PRODIGY Drugs lists the drugs recommended by PRODIGY, and links them to the condition and situation in which they are recommended

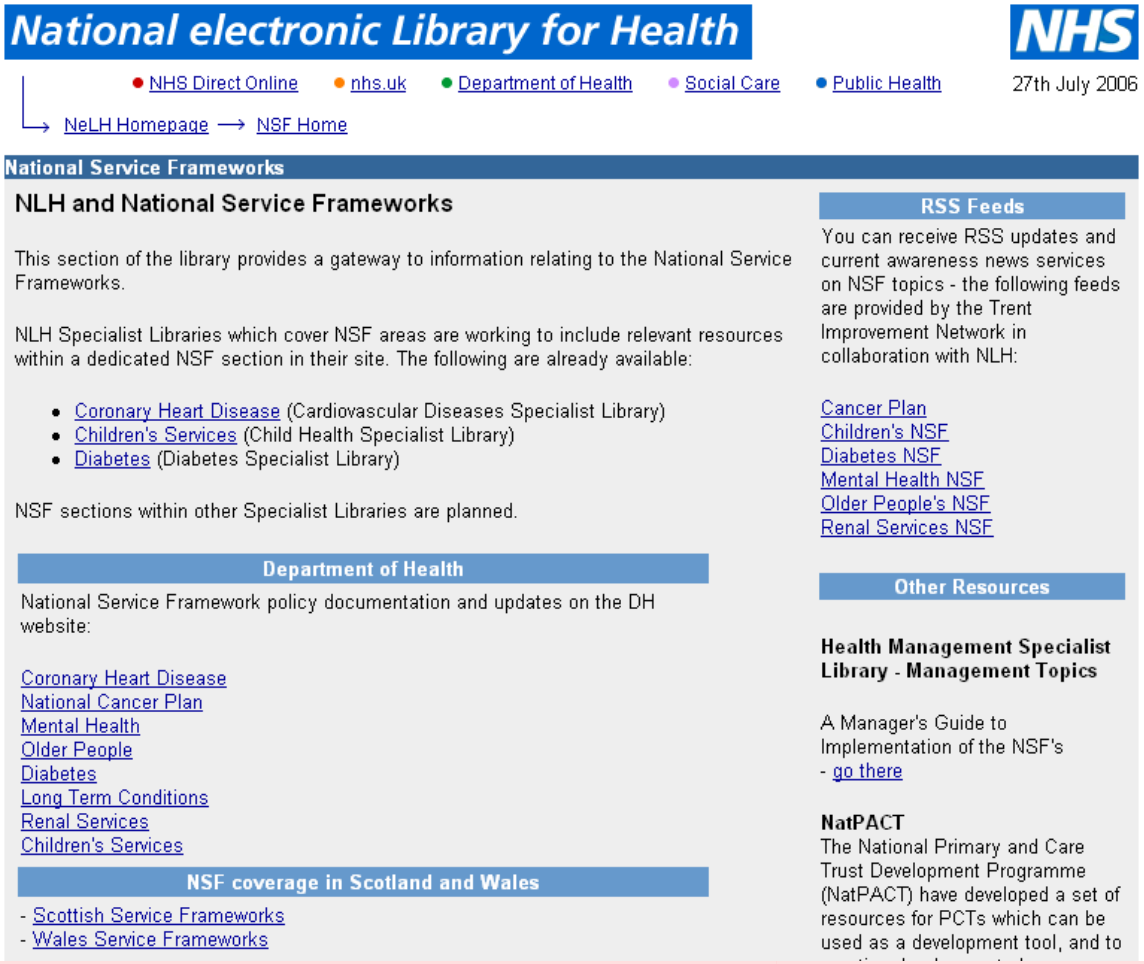


National Service Frameworks

http://www.nhs.uk/nhsengland/NSF/pages/Nationalserviceframeworks.aspx

- National service frameworks (NSFs) are long term strategies for improving specific areas of care. They set measurable goals within set time frames.

- Coronary Heart Disease
  National Cancer Plan
  Mental Health
  Older People
  Diabetes
  Long Term Conditions
  Renal Services
  Children's Services



National electronic Library for Health

NHS

NHS Direct Online · nhs.uk · Department of Health · Social Care · Public Health

27th July 2006

NeLH Homepage → NSF Home

National Service Frameworks

NLH and National Service Frameworks

This section of the library provides a gateway to information relating to the National Service Frameworks.

NLH Specialist Libraries which cover NSF areas are working to include relevant resources within a dedicated NSF section in their site. The following are already available:

- Coronary Heart Disease (Cardiovascular Diseases Specialist Library)
- Children's Services (Child Health Specialist Library)
- Diabetes (Diabetes Specialist Library)

NSF sections within other Specialist Libraries are planned.

Department of Health

National Service Framework policy documentation and updates on the DH website:

Coronary Heart Disease
National Cancer Plan
Mental Health
Older People
Diabetes
Long Term Conditions
Renal Services
Children's Services

NSF coverage in Scotland and Wales

- Scottish Service Frameworks
- Wales Service Frameworks

RSS Feeds

You can receive RSS updates and current awareness news services on NSF topics - the following feeds are provided by the Trent Improvement Network in collaboration with NLH:

Cancer Plan
Children's NSF
Diabetes NSF
Mental Health NSF
Older People's NSF
Renal Services NSF

Other Resources

Health Management Specialist Library - Management Topics

A Manager's Guide to Implementation of the NSF's - go there

NatPACT

The National Primary and Care Trust Development Programme (NatPACT) have developed a set of resources for PCTs which can be used as a development tool, and to

Clinical Evidence
Best Treatments

www.clinicalevidence.org
www.besttreatments.org

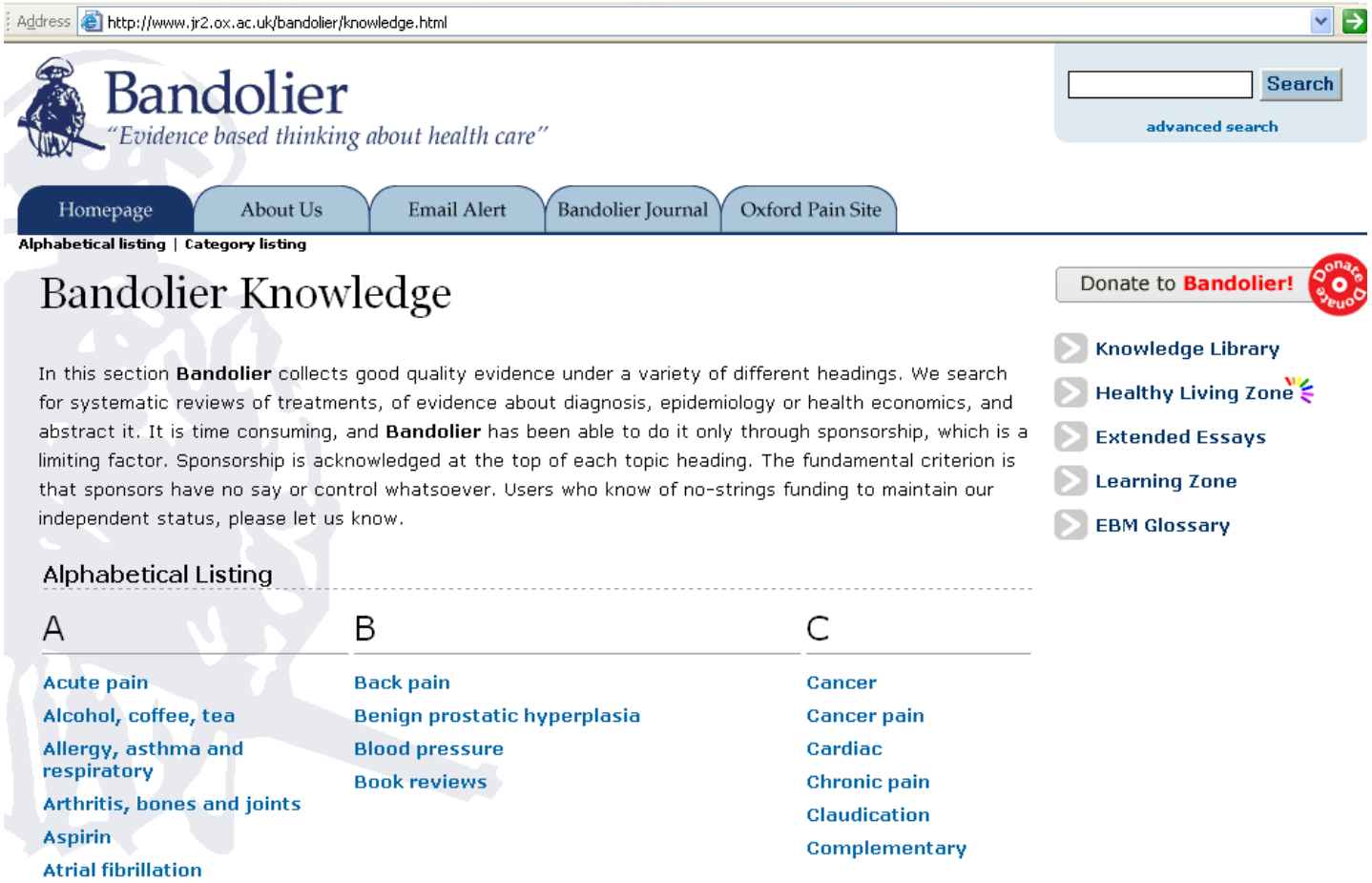
And similar resources from Walters Klouwer
John Wiley
Thomson Medical
Zinx

The Cochrane Library (www.cochrane.org)

- A collection of databases that contain high-quality, independent evidence to inform healthcare decision-making.
- Now owned by John Wiley Ltd

Bandolier

- The first issue of Bandolier, an independent journal about evidence-based healthcare, written by Oxford scientists, was printed in February 1994.
- It has appeared monthly ever since and has become the premier source of evidence based healthcare information in the UK and worldwide for both healthcare professionals and consumers.



British National Formulary

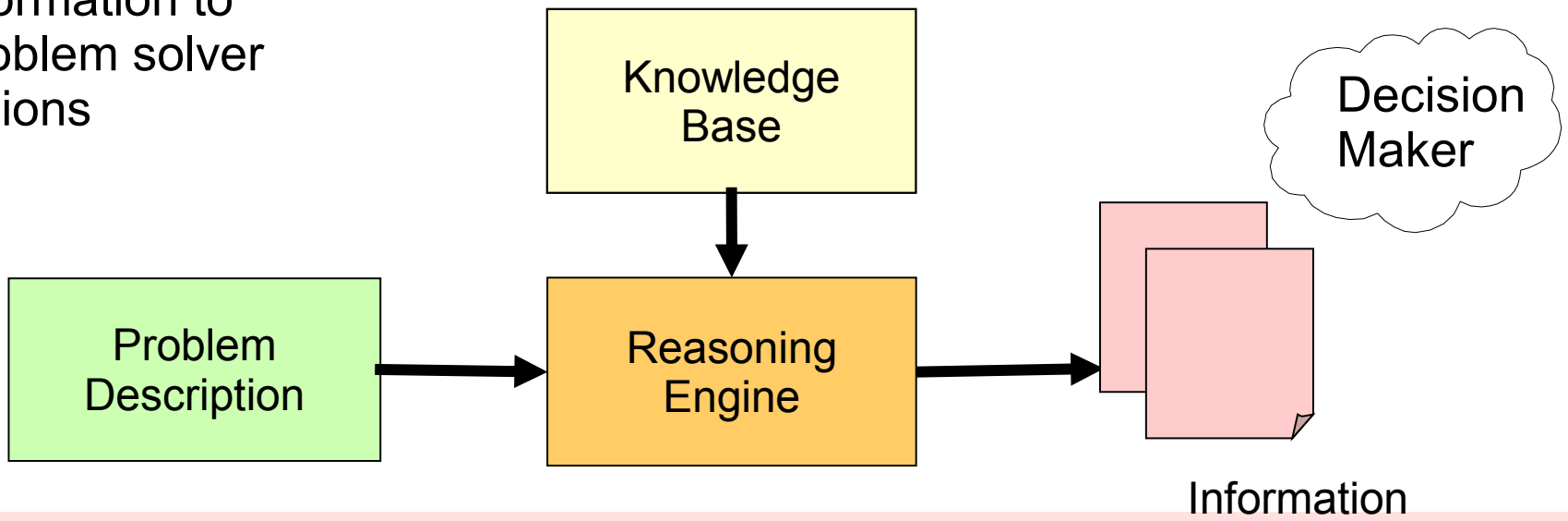
www.bnf.org

Decision Support System

An interactive, flexible, and adaptable computer-based information system, especially developed for supporting the solution of a non-structured management problem for improved decision making.

It utilizes data, provides an easy-to-use interface, and allows for the decision maker's own insights.

Reasoning Engine delivers information to help the problem solver make decisions

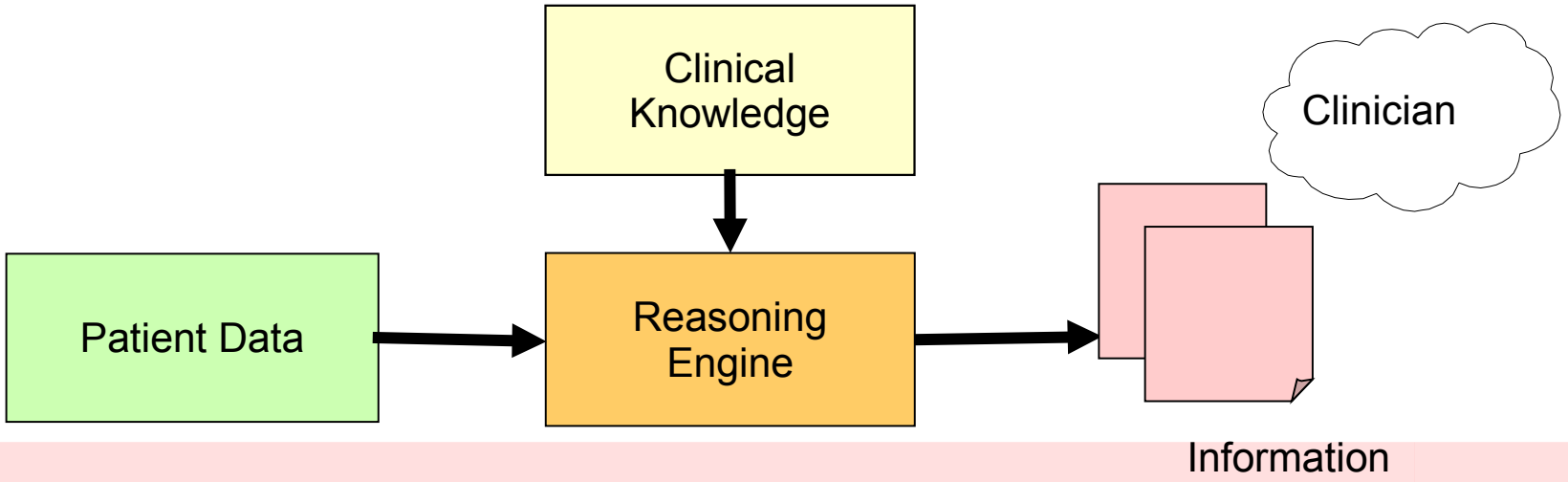


Clinical Decision Support System

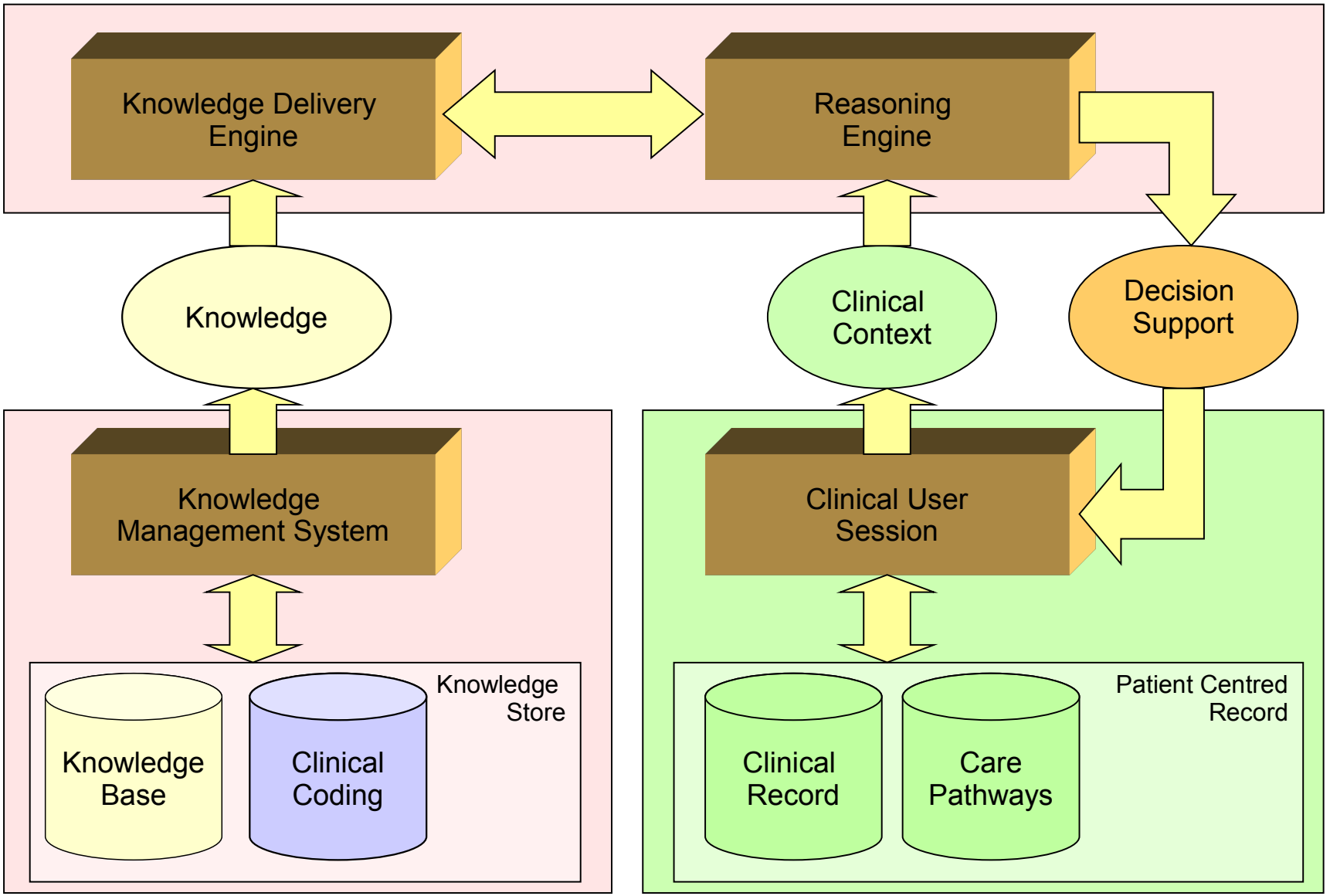
Clinical Decision Support Systems are "active knowledge systems which use two or more items of patient data to generate case-specific advice".[5]

Clinical Decision Support Systems are typically designed to integrate a medical knowledge base, patient data and an inference engine to generate case specific advice.

- This definition and much other useful information can be found at www.openclinical.org



The Full Nine Yards



References and Further Reading

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3. EN 13606-1:2007: Health informatics – Electronic health record communication – Part 1: Reference model. CEN – European Committee for Standardization. Also published as ISO 13606-1:2008, ISO-International Organization for Standardization.

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2. Lord Darzi. High quality care for all: NHS Next Stage Review final report. DH. SBN 978-0-10-174322-8
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3. Department of Health. Health informatics review report
   http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_086073

4. Clement J. McDonald, J. Marc Overhage, Paul Dexter, Blaine Y. Takesue, Diane M. Dwyer. A Framework for Capturing Clinical Data Sets from Computerized Sources. Annals of Internal Medicine. October 15, 1997 vol. 127 no. 8 Part 2 675-682.

Further Reading

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Further Reading

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